

Note

A substantial eastern disjunction of Douglas' Knotweed (*Polygonum douglasii* Greene, Polygonaceae) in New Brunswick, Canada

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Abstract

We report an isolated population of the native annual Douglas' Knotweed (*Polygonum douglasii* Greene) from a dry, south-facing outcrop of conglomerate and sandstone at Big Bluff, near Sussex Corner, New Brunswick, Canada, consisting of about 2500 plants in 2018 and 2022. This occurrence is disjunct by ~450 km from the eastern limit of the known range of Douglas' Knotweed in southwestern Maine, USA. The nearest known occurrence in Canada is in southern Quebec, ~660 km from Big Bluff. Several lines of evidence indicate that the population in New Brunswick is native. New state records for Wisconsin and Alaska found in online data sources are also verified.

Key words: Range disjunction; *Polygonum douglasii*; Douglas' Knotweed; New Brunswick; Wisconsin; Alaska

Douglas' Knotweed (*Polygonum douglasii* Greene, Polygonaceae) is an endemic North American species of dry, open, usually rocky habitats. It occurs in western montane regions from southern Yukon to northern Mexico and irregularly eastward through the southern boreal forest, the Great Lakes region, and into New England (Figure 1). Here we document a previously unreported occurrence at Big Bluff, Kings County, New Brunswick (Figures 2 and 3). This is the first report of the species in New Brunswick where it is disjunct beyond the eastern limit of its continuous range by ~450 km.

On 30 June 2018, we collected immature plants too young for definitive identification, but believed to be Douglas' Knotweed, at Big Bluff, and cultivated them off-site in garden soil. We photographed flowering cultivated plants on 8 August 2018 and collected vouchers from the wild population on 14 August 2018 (G. Bishop GB 18-632; NBM VP-043980 and UNB 69470, New Brunswick Museum and University of New Brunswick herbaria, respectively). Our determination of the specimens as Douglas' Knotweed relied primarily on the Flora of North America treatment (Costea *et al.* 2005).

Douglas' Knotweed is a slender, annual member of *Polygonum* section *Duravia* S. Watson (sometimes treated as the genus *Duravia* (S. Watson) Greene, as in Weakley and Southeastern Flora Team 2022). The section *Duravia* includes 18 species that occur west of the Mississippi River as well as Douglas' Knotweed and Slender or Pleat-leaved Knotweed (*Polygonum tenue* Michaux), found in eastern North America (Costea and Tardif 2005; Costea *et al.* 2005). Molecular research suggests that species formerly treated in the genus *Polygonella* Michaux also belong within *Polygonum* section *Duravia* (Schuster *et al.* 2011).

Douglas' Knotweed plants from Big Bluff have flat (unpleated) leaves with ocreae 2–6 mm long, pedicels >2 mm long and reflexed so that the flowers face downward, flowers partly open, and perianth >2 mm long. These characteristics separate them from Pleat-leaved Knotweed (pleated leaves, ocreae 6–15 mm long, pedicels to 1.5 mm long and erect, flowers closed, perianth 2.5–4.2 mm). Coastal Jointweed (*Polygonum articulatum* L.) is the only other member of section *Duravia* in the northeastern United States and adjacent Canada. It has spread to sandy roadsides in southwest New Brunswick from its native range

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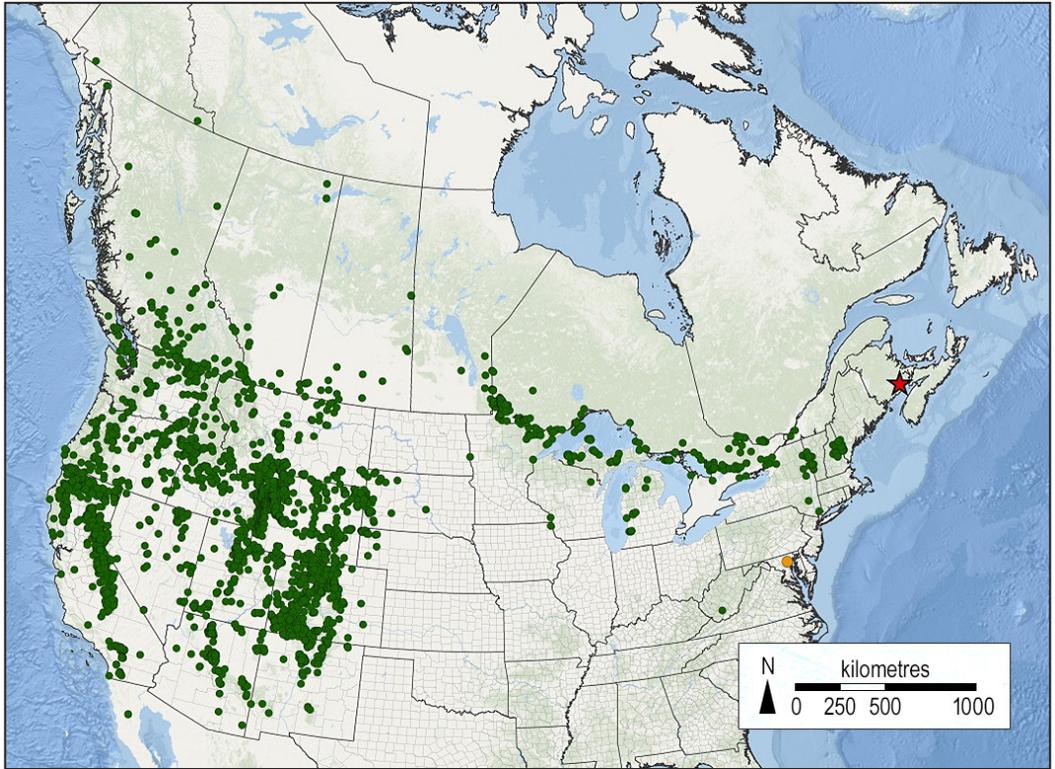


FIGURE 1. Distribution of Douglas' Knotweed (*Polygonum douglasii*) based on compiled digital records (data provided in Appendix S1). Sources were: Kartesz (2015), AC CDC (2022), GBIF (2022), New York Flora Atlas (2022), SEINet (2022), Centre de Données sur le Patrimoine Naturel du Québec (pers. comm. 5 October 2022), Saskatchewan Conservation Data Centre (pers. comm. 13 October 2022), Fraser Herbarium at University of Saskatchewan (pers. comm. 19 October 2022), specimen records of Daniel Brunton (pers. comm. 24 May 2023), and the personal observations of C.S.B. The star in New Brunswick is the occurrence at Big Bluff. The Maryland occurrence (orange dot) is introduced (C. Frye pers. comm. 13 October 2022); all other records are considered native (NatureServe 2023).

south and west of the province (Hinds 2000; Hill and Blaney 2010) but differs from Douglas' Knotweed in having minute and early-deciduous leaves, pedicels with a swollen joint, and strongly overlapping ocreae (versus persistent leaves, pedicels not swollen, ocreae not strongly overlapping; Costea and Tardif 2005; Costea *et al.* 2005). All other New Brunswick *Polygonum* species are classified in the cosmopolitan *Polygonum* section *Polygonum*, from which Douglas' Knotweed differs in having leaves that lack obvious secondary veins (versus leaves with distinct pinnate venation), nodding pedicellate flowers well-exserted from the ocreae (versus flowers enclosed within or only slightly exserted from the ocreae), four-angled stems (versus 8–16-ribbed stems), and pink to purple anthers (versus whitish yellow anthers).

The Douglas' Knotweed population at Big Bluff occurs on thin soil in a narrow band (up to ~7 m wide) of open habitat along the crest of the exposed bluff and slightly down the slope, at an elevation of ~150

m above sea level. The occurrence extends ~255 m from east to west, centred at 45.6997°N, 65.4407°W (Figures 2 and 3). Plants occur fairly continuously with sporadic gaps of 10–50 m. The population consisted of ~2500 plants in 2018 and 2022. Many individuals exhibit thin, unbranched stalks ~20 cm tall, and the largest plants are 35–40 cm tall with multiple branches. Plants are most plentiful in narrow, linear troughs about 10–20 cm wide and 3–7 m long along the bluff. Plants are generally absent immediately adjacent to a footpath that runs along the top of the bluff, where a dense band of the introduced Canada Bluegrass (*Poa compressa* L.) predominates.

The substrate at the site consists of sandstone conglomerate, listed in Barr *et al.* (2005) as red to grey, granule to cobble polymictic conglomerate and lithic sandstone. At the Big Bluff site, plants occupy dry, rocky, sparsely vegetated openings below a moderately open and dry ridge-top forest dominated by Red Oak (*Quercus rubra* L.). Other locally frequent species



FIGURE 2. a. Location of Douglas' Knotweed (*Polygonum douglasii*) at Big Bluff, Sussex Corner, New Brunswick, Canada, 45.6998°N, 65.4409°W. The line indicates the extent of the *P. douglasii* occurrence on Big Bluff. Image source: Google Earth Pro 7.3.4.8642. Imagery date: 22 August 2008. Data provider: CNES/Airbus. Accessed 10 October 2022. b. Location of Douglas' Knotweed occurrence in New Brunswick. Base maps from ESRI ArcGIS.

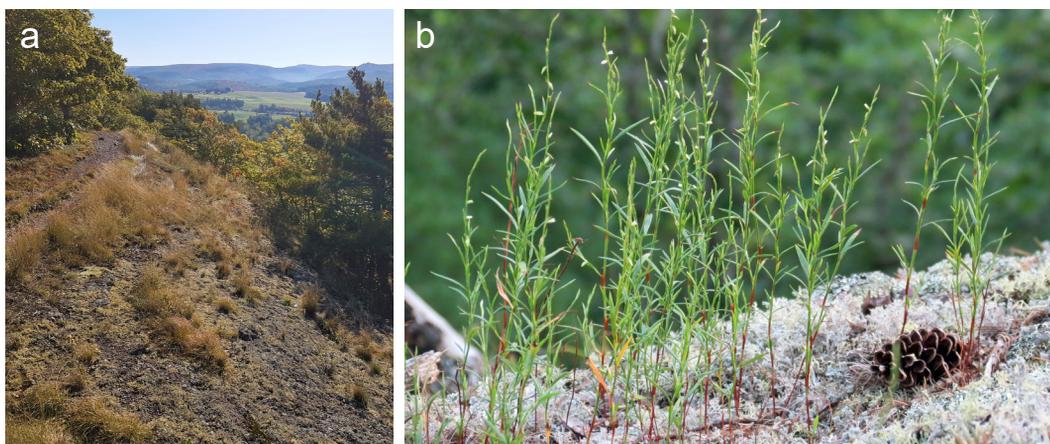


FIGURE 3. a. Douglas' Knotweed (*Polygonum douglasii*) ridge crest habitat with heavily used walking trail running through it. b. Plants growing *in situ* at Big Bluff, 30 June 2018. Photo a: Stephen Clayden. Photo b: James Goltz.

associated with Douglas' Knotweed at the site include native vascular plants Poverty Oat-grass (*Danthonia spicata* (L.) Beauvois ex Roemer & Schultes), Rock Spikemoss (*Selaginella rupestris* (L.) Spring), Common Bearberry (*Arctostaphylos uva-ursi* (L.) Sprengel), Three-toothed Cinquefoil (*Sibbaldia tridentata* (Aiton) Paule & Soják), Cow-wheat (*Melampyrum lineare* Desrousseaux), White Goldenrod (*Solidago bicolor* L.), and Round-leaved Serviceberry (*Amelanchier sanguinea* (Pursh) de Candolle) along with non-native Common St. John's-wort (*Hypericum*

perforatum L.) and Canada Bluegrass. Bristly Haircap Moss (*Polytrichum piliferum* Hedwig), Fire Moss (*Ceratodon purpureus* (Hedwig) Bridel), Green Reindeer Lichen (*Cladonia mitis* Sandstede), Thorn Lichen (*Cladonia uncialis* (L.) Weber ex F.H. Wiggers), Easter Foam Lichen (*Stereocaulon paschale* (L.) Hoffmann), Peppered Rock-shield Lichen (*Xanthoparmelia conspersa* (Acharius) Hale), and Cumberland Rock-shield Lichen (*Xanthoparmelia cumberlandia* (Gyelnik) Hale) are also associated with Douglas' Knotweed at Big Bluff.

Douglas' Knotweed is rare along the eastern margin of its range, with NatureServe ranks of S3 (Vulnerable) in Quebec, S2 (Imperilled) in Vermont, New Hampshire, and Maine, S1S2 (Critically Imperilled to Imperilled) in New York, and SH (Possibly Extirpated) in West Virginia (NatureServe 2023), although Harmon *et al.* (2006) considered the West Virginia population of *P. douglasii* spp. *douglasii* to be adventive (North American native arriving in West Virginia without known intentional introduction). The known occurrences nearest to New Brunswick are in southwestern Maine, 450 km southwest of Big Bluff (Maine Natural Areas Program 2022). The nearest occurrences in Canada are in southern Quebec in the vicinity of Montréal, 660 km west of Big Bluff. A record from the Québec City area (*Néron 80-233*, QFA0488505 [Herbier Louis-Marie], <https://www.gbif.org/occurrence/1248740155>) was determined to be Marshpepper Smartweed (*Persicaria hydropiper* (L.) Delarbre; J. Labrecque pers. comm. 5 October 2022).

Several lines of evidence contribute to our conclusion that Douglas' Knotweed at Big Bluff is native. First, human-assisted transport over long distances from natural openings is not frequent based on the comments of experienced eastern North American field botanists (e.g., C.S.B. pers. obs. [Ontario]; pers. comm. 13 October 2022 from Don Cameron [Maine], Aaron Marcus [Vermont], Jacques Labrecque [Quebec], Michael Oldham [Ontario], and Anton Reznicek [Michigan]). Aside from the possibly adventive record in West Virginia, the only known instance of extra-limital occurrence is a single Maryland record. It was reported from an ore pile on the Baltimore waterfront (Reed 1964), and the species is not considered a persistent member of the Maryland flora (C. Frye pers. comm. 13 October 2022).

Second, the extensive dry, south-facing rock barren habitat at Big Bluff supports at least three other provincially rare native species of southern and western affinity, two of which are also at or near their extreme eastern range limit: Rock Spikemoss, S1 in New Brunswick, and Back's Sedge (*Carex backii* Boott), S1 in New Brunswick (AC CDC 2022). The third rare species is American False Pennyroyal (*Hedeoma pulegioides* (L.) Persoon), S3 in New Brunswick and in Nova Scotia.

Third, habitat at Big Bluff is typical of other natural occurrences of the species in eastern North America, e.g., "rocky slopes and dry soil" in northeast North America (Fernald 1950: 580); "rocky summits and rock outcrops in forest openings, woodlands, and graminoid dominated native meadows ... in cracks in non-shaded calcareous bedrock outcrops" in New York (New York Flora Association 2022); and "thin

soil of ledges, cliff bases, and rocky woodlands" in New England (Native Plant Trust 2022).

The absence of Douglas' Knotweed records at Big Bluff before 2018 despite at least nine visits by knowledgeable botanists (AC CDC 2022) is likely a result of the species being overlooked. Most visits were by botanists not familiar with the species and at least seven of the visits were before its mid-July flowering time or in late summer or autumn when plants may have dropped leaves and fruit.

Douglas' Knotweed is currently ranked S1 (Critically Imperilled) in New Brunswick by the Atlantic Canada Conservation Data Centre and New Brunswick Department of Natural Resources and Energy Development (AC CDC 2022). The species is intrinsically vulnerable in the province because of its limited range and small total population. Furthermore, it is significantly threatened by heavy use of the popular Sussex Bluffs Trail, which can damage or kill developing plants, promote plant community change toward dominance of exotic Canada Bluegrass, and permanently remove habitat via erosion of the thin layer of soil and vegetation over bedrock (Figure 3). A substantial portion of its open slope rim habitat, which is generally <7 m wide, is occupied by the trail, and trail impacts are likely increasing.

In researching this paper, we verified new state records of Douglas' Knotweed from Wisconsin (45.335262°N, 88.252213°W, 15 August 2022, observed by Schmitt [iNaturalist 2023a]; 45.32368°N, 88.34930°W, 19 June 2022, observed by Nate Martineau [iNaturalist 2023b]; identifications of both observations verified by C.S.B. and M. Costea) and Alaska (edge of highway ca. 18 miles [29 km] north of Haines, 4 August 1975, *J. Taylor 20084*, KANU-269308 [R.L. MacGregor Herbarium, Kansas University], <https://www.gbif.org/occurrence/177009443>; verified by C. Freeman, pers. comm. 28 October 2022). The absence of previous state records for Wisconsin was confirmed by M. Feist (pers. comm. 19 October 2022) and for Alaska by J. Fulkerson (pers. comm. 28 October 2022). The Wisconsin occurrences should be documented with voucher specimens.

Four states, for which the only records we are aware of are collections mediated by GBIF (2022) or in Costea *et al.* (2005), are excluded from the distribution of Douglas' Knotweed based on the following.

- Texas: 2 mi. [3 km] E of Glenrio, 17 August 1960, *S.F. Glassman 5436*, F-2265123 [Field Museum], <https://www.gbif.org/occurrence/1424771927>; misidentified, a *Polygonum* section *Polygonum* species.
- Oklahoma: NY [New York Botanical Garden], <https://www.gbif.org/occurrence/1929076579>. Databasing error. This sheet contains two col-

lections. NY 04266953 is *Polygonum douglasii* from “Banner County, Nebraska, 10 July 1891, *P.A. Rydberg 346*”. NY 03141693 from “Oklahoma, Indian Territory, chiefly on the False Washita [River], between Fort Cobb and Fort Arbuckle, 1868, *E. Palmer 288*”, includes immature plants identified as *P. tenue* by Palmer, and is annotated in pencil as “not *douglasii*” by a later botanist.

- Illinois: Beardstown, 17 August 1924, *H.C. Benke 3924*, F-V0388004F (<https://www.gbif.org/occurrence/1424771939>); identification not confirmable via image by taxon expert M. Costea (pers. comm. 19 October 2022), and the similar *Polygonum tenue* would be more likely in southern Illinois.
- Virginia: Reported from Virginia in Costea *et al.* (2005), but origin of report not known to Costea (pers. comm. 19 October 2022) nor to Virginia Natural Heritage Program (J. Townsend pers. comm. 13 October 2022), and also excluded by Weakley *et al.* (2022).

Author Contributions

Conceptualization: G.B., C.S.B., S.R.C., and J.P.G.; Investigation: G.B., C.S.B., S.R.C., and J.P.G.; Writing – Original Draft: C.S.B., G.B., and S.R.C.; Writing – Review & Editing: C.S.B., G.B., and S.R.C.

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collection records. John Townsend (Virginia Natural Heritage Program) provided information on the Virginia report of *P. douglasii* in Flora of North America. Chris Frye (Maryland Natural Heritage Program) provided details of the ephemeral Maryland occurrence reported from Baltimore. Craig Freeman (Kansas Biological Survey) confirmed the identification of the Alaska specimen at University of Kansas. Justin Fulkerson (Alaska Natural Heritage Program) and Mary Ann Feist (Wisconsin Herbarium, University of Wisconsin at Madison) confirmed that Alaska and Wisconsin records represented first occurrences for their states. Charity Robicheau (Atlantic Canada Conservation Data Centre) produced the maps.

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SUPPLEMENTARY MATERIAL:

APPENDIX S1. Data used to generate distribution map of Douglas' Knotweed (*Polygonum douglasii*).